

Database of extratropical cyclones identified as being occluded:

Theory and Method: Jonathan Martin and Poushali Ghosh, Univ. Wisconsin Madison, 2020-2021.

Automation: Catherine Naud, Columbia Univ./NASA-GISS, 2021.

Citation: Naud et al. QJRM 2023. Qj.4491

A full description of the method that identifies cyclones that are undergoing an occlusion is available in the QJRM manuscript. For this database we applied the method using 1000:500hPa thickness fields obtained from the MERRA-2 reanalysis. The output includes the location of the area of the thickness ridge for each cyclone identified as occluded.

There are two types of information in the database:

- A text file that lists the 6-hourly cyclone identifications that are occluded for users who just want to know when and where they are. The lists are for a year.
- A series of netcdf files that contain information on the cyclone history, characteristics and the location of the thickness ridge that characterizes the occlusion. The files are arranged into monthly folders.

Because the work was conceived to use CloudSat and CALIPSO data, the data series starts in September 2006 and finishes in December of 2017. We anticipate that this will likely be extended to more recent years, but there are no plans as yet to go back in time.

The data is arranged as follow: each extratropical cyclone track is divided into 6-hourly snapshots, and the snapshots that are identified as being occluded are saved independently from one another. Information on the actual track to which the occluded cyclone snapshot belongs to is provided in the file name.

The file names are as follow:

Flaggedoccl_YYYYMMDD_TT_LAT_LONG_surfaceType_TrackID_MERRA21deg.ncdf

Where:

YYYYMMDD is the year, month and day when the cyclone occurs

TT is the time at which it occurs, in 6-hours increments (00, 06, 12, 18) UTC

LAT: is the latitude of the cyclone center (the point with the minimum in SLP)

LONG: is the longitude of the cyclone center.

surfaceType: ocean or land at the location of the cyclone center (the thermal ridge might be over a different surface type in coastal regions)

TrackID: the unique identifier of the track to which the 6-hourly cyclone snapshot belongs to

MERRA21deg: indicates that the input used to identify the occlusion is MERRA-2 degraded to 1°x1.25° horizontal resolution

The files are arranged in monthly folders and zipped together. While each file only amounts to 126 kb, their number varies from one month to another, making the monthly folder differ in size.

Each file contains information on the cyclone, the MERRA-2 fields that are used to flag occlusions, and information on the area identified as the thermal/thickness ridge:

- Storminfo: a 5 element vector that contains information on the cyclone: longitude of center (SLPmin), latitude of center, SLP at center, land fraction at center (0-1) and age (in number of hours to peak intensity)
- Longitude: 2D array of longitude in surrounding area of the cyclone from MERRA-2
- Latitude: same but containing latitude of the grid cells
- Slp: 2D SLP field from MERRA-2 in area surrounding the cyclone
- Surfelev: 2D array of surface elevation from MERRA-2
- Stdsurfelev: 2D array of standard deviation of surface elevation calculated with respect to elevation in the 8 neighboring grid cells
- Thickness: 2D array of 500-1000hPa thickness from MERRA-2
- Fparam: 2D array of calculated F parameter based on thickness in the cyclone area
- Thetae: 3D array of equivalent potential temperature calculated from MERRA-2 T & q data
- Plev: pressure levels used for thetae
- Clusterlon: longitude of data points flagged as being part of the thermal ridge area (where $F < 10^{-9} \text{ m}^{-1}$)
- Clusterlat: latitude of cluster points
- Clusterf: value of F at the thermal ridge cluster locations
- Trackinfo: longitude, latitude and age of all ETCs that constitute the track to which this occluded ETC belongs to. By matching the longitude and latitude from storminfo to trackinfo list, one can derive when this particular occluded occurrence happened in the history of this system. Age also provides information on when, during the life of the cyclone, peak intensity was reached.